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Symbiotic stars on Asiago archive plates*

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Abstract. The rich plate archive of the Asiago observatory has been searched for plates containing the symbiotic stars AS 323, Ap 3-1, CM Aql, V1413 Aql (= AS 338), V443 Her, V627 Cas (= AS 501) and V919 Sgr. The program objects have been found on 602 plates, where their brightness has been estimated against the $UBV(RI)_{\rm C}$ photometric sequences calibrated by Henden and Munari (2000).

AS 323 is probably eclipsing, with a preliminary P=197.6 day period. If confirmed, it would be the shortest orbital period known among symbiotic stars. CM Aql does not seem to undergo a series of outbursts, its lightcurve being instead modulated by a large amplitude sinusoidal variation with a P∼1058 day period. V627 Cas presents a secular trend in agreement with the possible post-AGB nature of its cool component.

Key words: Binaries: symbiotic

1. Introduction

The time scale of variability for symbiotic stars is quite long: the orbital periods range from ∼1 year up to several decades while rise and decay from an outburst may take anything from a few years to more than a century (cf. Kenyon 1986).

Such long time scales tend to discourage stand-alone photometric campaigns from a single Observatory, which could pay dividends only after ten or more years. Most of the current photometric investigations of symbiotic stars therefore try to assemble as much as possible data from the widest set of current and archival sources. Template examples are the reconstruction of the 1890-1996 lightcurve of YY Her by Munari et al. (1997) and the 1885-1988 lightcurve of CH Cyg by Mikolajewski et al. (1990). Both required a huge effort in locating and measuring historical material in plate archives around the world.

Henden and Munari (2000,2001) have so far provided accurate and extended $UBV(RI)_{\rm C}$ photometric comparison sequences around 40 symbiotic stars, intended to assist both present time photometry as well as measurement of photographic plates from historical archives. They should stimulate small observatories and/or occasional observers to obtain new data as well as to encourage those with access to old plate archives to search for valuable historical data. Assembling such data (obtained at various Observatories against the same comparison sequences to minimize systematic errors) will result in a much better understanding of the photometric evolution and therefore the physical nature of this intriguing class of interacting binaries.

In this paper we present the results of digging the Asiago plate archive for seven symbiotic stars: AS 323, Ap 3-1, CM Aql, V1413 Aql (= AS 338), V443 Her, V627 Cas (= AS 501) and V919 Sgr.

2. Data acquisition

Two Schmidt telescopes were operated at Asiago observatory. The smaller one (40/50 cm, 100 cm focal length) collected 20417 plates from 1958 to 1992, and the larger one (67/92 cm, 208 cm focal length) 18811 plates from 1965 to 1998. The Asiago Schmidt plate collection thus span 40 years. The majority of the plates match the B band, but the U, V, R_C and I_C bands are well represented too.

The plates are typically filed in the archive logs with the coordinates of the object to which they were aimed, that generally does not lay in the plate center (which is instead usually the case for the guiding star).

Therefore, for a given program star, we initially selected from the archive logs the plates to inspect as if they were covering a 2×2 wider area. A subsequent visual inspection of all the selected plates separated those actually containing the program star (602 plates) from the others.

We then proceeded to estimate at an high quality binocular microscope the magnitude of the program star

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* Table 1 is only available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/cgi-bin/qcat?J/A+A/

Table 1. The $UBV(RI)_C$ magnitudes of the program stars estimated on the Asiago archive plates. The date is given in the year/month/day format, the heliocentric JD is $HJD = JD_\odot - 2400000$ and the magnitude is estimated in steps of 0.05 mag.

date	*HJD*	*mag*	*date*	*HJD*	*mag*	*date*	*HJD*	*mag*
AS 323			**AS 323**			**Ap 3–1**		
1961 08 05	37517.414	B=15.45	1973 09 19	41945.339	B=15.50	1971 11 06	41262.238	B=18.20
1961 08 06	37518.415	B=15.45	1973 09 27	41953.275	R=12.50	1971 11 20	41276.210	I=13.40
1961 08 07	37519.424	B=15.50	1973 09 27	41953.293	V=14.20	1971 11 20	41276.230	B=18.20
1961 08 08	37520.420	B=15.50	1973 09 27	41953.309	B=15.30	1972 08 03	41533.402	I=13.20
1961 08 09	37521.442	B=16.60	1973 09 28	41954.272	R=12.50	1972 08 13	41543.477	I=13.10
1961 08 10	37522.444	B=15.70	1973 09 28	41954.288	R=12.55	1972 08 17	41547.427	B=18.70
1961 08 11	37523.467	B=15.35	1973 10 02	41958.269	V=14.40	1972 08 17	41547.446	I=13.00
1961 08 12	37524.471	B=15.30	1975 06 19	42582.517	B=15.50	1972 09 28	41589.274	B=18.20
1961 08 17	37529.427	B=15.50	1975 06 19	42582.527	V=14.45	1972 09 28	41589.290	I=12.45
1961 08 18	37530.448	B=15.55	1975 07 02	42596.454	B=15.45	1972 10 04	41595.323	I=13.00
1961 08 29	37541.354	B=15.70	1975 07 02	42596.466	V=15.45	1972 10 04	41595.344	B=18.60
1961 08 30	37542.371	B=15.80	1975 08 03	42628.441	V=14.40	1972 10 31	41622.270	I=13.10
1961 08 31	37543.385	B=15.60	1975 08 03	42628.460	B=15.40	1972 10 31	41622.287	B=18.20
1961 09 01	37544.382	B=15.70	1975 10 06	42692.333	V=14.25	1972 11 02	41624.246	I=13.15
1961 09 03	37546.338	B=15.70	1975 10 29	42715.265	B=15.30	1972 11 02	41624.263	B=18.50
1961 09 04	37547.396	B=15.70	1975 10 29	42715.288	V=14.40	1972 11 06	41628.246	I=13.10
1961 09 06	37549.388	B=15.65	1976 07 31	42991.436	V=14.30	1972 11 06	41628.265	B=18.30
1961 09 07	37550.345	B=15.70	1976 07 31	42991.463	B=15.20	1973 08 18	41913.341	B=18.20
1961 09 09	37552.374	B=15.70	1976 08 19	43010.385	B=15.30	1973 08 18	41913.361	I=13.40
1961 09 10	37553.378	B=15.70	1976 08 19	43010.386	V=14.45	1973 08 24	41919.449	V=17.00
1961 09 13	37556.341	B=15.75	1977 07 23	43348.399	I=11.95	1973 08 29	41924.402	V=16.90
1961 09 15	37558.369	B=15.70	1977 07 24	43349.469	I=12.15	1973 10 03	41959.371	I=13.60
1961 09 16	37559.358	B=15.75	1977 07 24	43349.486	V=14.40	1973 10 17	41973.345	I=13.50
1961 09 17	37560.403	B=15.40	1977 08 10	43366.371	V=14.35	1974 07 22	42251.475	B=18.20
1961 09 26	37569.292	B=15.10	1977 08 10	43366.387	I=12.15	1974 07 29	42258.482	I=13.00
1961 10 02	37575.341	B=15.40	1977 09 06	43393.317	I=12.10	1974 08 14	42274.371	B=18.50
1961 10 05	37578.327	B=15.35	1977 10 04	43421.265	B=15.30	1974 08 14	42274.393	I=13.35
1961 10 09	37582.313	B=15.40	1977 10 04	43421.286	I=12.10	1974 09 09	42300.425	B=18.20
1961 10 10	37583.326	B=15.25	1978 09 28	43780.389	V=14.35	1974 09 09	42300.445	I=13.65
1962 06 08	37824.487	B=15.10	1978 09 28	43780.406	I=12.10	1974 09 13	42304.384	B=18.40
1962 06 24	37840.422	B=15.20	1980 08 09	44461.413	B=16.00	1974 09 13	42304.404	I=13.65
1962 08 06	37883.430	B=15.35	1989 09 22	47792.306	B=16.10	1975 05 18	42550.569	V=17.00
1963 07 19	38230.463	B=15.35	1989 10 05	47805.306	B=16.50	1975 05 18	42550.588	B=18.50
1964 09 07	38646.403	B=15.35	1989 10 07	47807.358	B=15.70	1975 06 18	42582.502	B=18.20
1965 06 27	38939.453	B=15.35	1990 05 19	48030.521	B=15.60	1975 10 30	42716.337	B=18.40
1965 06 27	38939.468	B=15.35	1990 07 19	48092.436	B=15.35	1976 09 17	43039.304	B=18.20
1965 10 24	39058.258	B=15.35	1990 07 19	48092.464	V=14.40	1976 09 17	43039.320	I=13.00
1966 05 26	39271.566	B=15.35	1990 07 20	48093.448	V=14.45	1976 10 21	43073.315	I=13.00
1970 08 03	40802.394	B=15.30	1990 08 21	48125.330	V=14.35	1976 10 21	43073.336	B=17.50
1970 08 03	40802.401	V=14.50	1990 08 23	48127.333	B=15.45	1977 06 19	43314.471	B=18.20
1970 08 05	40804.371	B=15.35	1991 07 15	48453.467	B=14.50	1977 06 19	43314.493	I=12.45
1970 08 10	40809.431	B=15.70				1977 07 18	43343.436	B=18.20
1970 08 10	40809.445	V=14.40	**Ap 3–1**			1977 07 19	43344.414	I=12.95
1970 08 11	40810.427	B=15.30				1977 08 12	43368.494	I=12.90
1970 08 11	40810.441	V=14.50	1969 07 16	40419.449	B=17.70	1977 08 13	43368.514	B=18.20
1970 09 06	40836.358	V=14.35	1970 06 13	40750.511	B=18.40	1977 09 05	43392.378	I=12.85
1970 09 06	40836.370	B=15.30	1970 07 05	40772.542	B=18.00	1977 09 05	43392.399	B=18.20
1970 09 06	40836.395	V=14.40	1970 07 28	40796.400	I=13.10	1977 09 09	43396.364	I=13.50
1970 09 06	40836.409	B=15.30	1970 08 04	40803.404	B=18.40	1977 09 09	43396.386	B=18.20
1970 10 21	40881.267	B=15.40	1970 08 04	40803.418	B=18.50	1977 10 03	43420.316	I=13.00
1970 10 21	40881.286	V=14.35	1970 08 05	40804.493	B=18.20	1977 10 13	43430.338	I=13.00
1970 10 22	40882.237	V=14.35	1970 08 24	40823.394	B=18.50	1978 08 10	43731.468	V=16.90
1970 10 22	40882.249	B=15.30	1970 09 06	40836.391	B=17.80	1978 08 10	43731.494	I=13.00
1970 10 26	40886.260	V=14.40	1970 09 28	40858.329	B=18.30	1978 08 30	43751.440	V=16.30
1970 10 26	40886.274	B=15.35	1970 10 25	40885.267	B=18.00	1978 08 30	43751.479	I=12.50
1971 06 15	41118.484	V=15.35	1971 07 01	41133.544	B=18.20	1978 10 05	43787.340	V=16.40
1971 06 19	41122.497	B=15.30	1971 07 02	41134.514	B=18.00	1978 10 05	43787.362	I=13.15
1971 10 18	41243.262	V=14.30	1971 07 02	41134.527	B=18.00	1978 10 29	43811.324	V=17.00
1971 10 20	41245.236	I=12.05	1971 09 11	41206.337	B=18.20	1978 11 24	43837.259	V=16.70
1971 10 20	41245.258	B=15.35	1971 09 11	41206.363	I=12.45	1979 07 18	44072.527	I=12.85
1972 07 06	41505.479	B=16.00	1971 09 17	41212.409	I=13.00	1979 08 13	44099.420	V=16.60
1972 07 06	41505.493	V=14.55	1971 09 17	41212.429	B=18.00	1979 08 13	44099.442	I=12.70
1972 05 12	41449.599	B=15.35	1971 09 21	41216.377	B=18.20	1979 08 21	44107.352	V=16.50
1972 06 18	41486.515	B=15.80	1971 09 21	41216.399	I=12.55	1979 08 29	44115.400	V=16.90
1972 06 19	41487.554	V=16.40	1971 10 08	41233.291	B=18.20	1979 08 29	44115.425	I=12.75
1972 08 04	41534.418	V=14.55	1971 10 08	41233.311	I=13.00	1979 10 10	44157.313	V=16.90
1972 08 12	41542.427	V=14.45	1971 10 20	41245.277	B=18.20	1979 10 20	44167.306	V=17.00
1973 09 19	41945.324	V=14.35	1971 10 20	41245.297	I=13.10	1979 10 29	44176.356	I=13.20
1973 09 19	41945.327	V=14.40	1971 11 06	41262.217	I=13.00	1980 05 13	44372.532	I=13.00

Table 2. (*continues*)

date	*HJD*	*mag*
Ap 3-1		
1980 06 15	44406.459	B=18.00
1980 06 15	44406.485	I=13.20
1980 09 04	44487.385	I=13.00
1980 09 04	44487.408	V=17.00
1981 06 05	44760.535	I=13.15
1981 06 05	44760.565	V=17.00
1982 05 28	45118.476	I=13.10
1982 05 29	45118.512	B=18.00
1982 06 15	45135.512	V=17.00
1982 08 13	45194.510	I=12.50
1982 08 23	45205.403	I=12.85
1982 09 17	45230.364	I=12.85
1982 09 17	45230.392	V=16.80
1983 06 15	45501.410	I=13.00
1983 06 15	45501.438	V=16.70
1983 07 02	45518.460	I=12.85
1983 08 04	45551.411	I=12.80
1983 08 11	45558.446	V=16.90
1983 09 05	45583.460	V=17.00
1983 09 29	45607.331	I=13.50
1984 07 28	45909.531	I=13.50
1984 08 03	45916.434	I=12.90
1985 08 12	46290.403	I=12.60
1985 08 12	46290.430	V=16.95
1985 08 21	46299.379	I=13.00
1985 09 06	46315.348	I=13.40
1986 10 28	46732.307	I=12.50
1988 08 07	47381.410	I=13.25
1988 08 07	47381.443	V=16.70
1988 08 10	47384.469	I=13.30
1988 09 07	47412.431	V=16.80
1988 09 07	47412.450	I=13.00
1988 09 17	47422.410	I=12.85
1988 09 18	47423.395	V=16.50
1990 08 21	48125.352	V=16.30
1990 08 21	48125.378	I=12.95
1992 07 03	48807.492	V=16.30
1992 07 04	48807.519	I=12.65
1992 08 02	48836.516	I=12.30
1992 09 02	48868.379	I=13.10
1992 09 02	48868.406	B=18.40
1993 05 21	49129.486	I=13.10
1993 05 22	49129.515	V=16.90
1993 07 14	49182.521	B=18.60
1993 07 14	49182.549	I=12.75
1993 08 15	49215.430	I=13.20
1994 08 12	49577.476	V=17.00
1995 05 05	49842.517	I=13.20
1995 05 05	49842.539	V=16.90
1995 06 25	49894.488	V=15.90
1995 09 26	49987.368	V=15.90
CM Aql		
1961 06 15	37466.491	B=16.20
1961 07 09	37489.511	B=16.10
1961 07 14	37494.535	B=16.40
1961 07 15	37495.514	B=16.40
1961 08 02	37514.422	B>15.30
1961 08 09	37521.407	B=16.40
1961 08 10	37522.427	B=15.80
1961 08 11	37523.484	B=16.40
1961 08 18	37530.464	B=16.40
1961 08 30	37542.385	B=16.40
1961 09 03	37546.354	B=16.30
1961 09 06	37549.402	B=16.40

date	*HJD*	*mag*
CM Aql		
1961 09 09	37552.388	B=16.40
1961 09 10	37553.392	B=16.40
1961 09 13	37556.363	B>15.30
1961 09 15	37558.386	B>15.30
1961 09 16	37559.373	B=16.40
1961 09 17	37560.419	B=16.50
1961 10 02	37575.359	B=16.40
1961 10 05	37578.342	B=15.70
1961 10 09	37582.329	B=15.50
1961 10 10	37583.342	B=16.05
1962 07 23	37869.439	B=14.40
1962 08 03	37880.500	B=14.60
1963 07 19	38230.474	B=15.50
1964 09 07	38646.415	B=15.60
1965 10 24	39058.276	B=13.70
1966 07 20	39326.527	B=14.70
1982 09 15	45228.366	V=13.50
V1413 Aql		
1962 03 15	37738.667	B=14.10
1962 05 01	37787.602	B=14.80
1963 10 11	38314.286	B=15.60
1963 10 12	38315.284	B=15.60
1963 10 16	38319.294	B=15.70
1963 10 19	38322.260	B=15.85
1963 10 21	38324.289	B=15.65
1963 11 07	38341.247	B=15.95
1963 11 17	38351.266	B=16.10
1964 11 05	38705.246	B=15.00
1965 10 23	39057.261	B=14.55
1966 07 16	39323.469	B=16.15
1966 09 22	39391.457	B=15.80
1967 06 30	39672.466	B=15.80
1967 07 04	39676.449	B=16.50
1967 10 21	39784.420	B=15.30
1967 10 22	39784.398	B=15.30
1967 11 24	39819.223	V=14.40
1967 11 24	39819.238	B=14.80
1968 07 22	40060.433	B=14.00
1968 08 24	40093.379	B=14.50
1968 09 11	40111.394	V=14.30
1968 09 24	40124.381	B=15.70
1968 11 22	40183.231	B=15.80
1969 08 17	40451.356	V=14.70
1969 09 11	40476.410	B=15.60
1969 10 29	40524.227	B=13.15
1969 11 01	40527.259	V=12.70
1969 11 28	40554.208	B=15.90
1970 07 06	40773.517	V=13.50
1970 09 09	40839.403	B=14.05
1970 10 26	40886.321	V=13.70
1970 10 26	40886.334	B=14.25
1971 03 31	41041.575	B=12.55
1971 03 31	41041.591	V=12.00
1971 08 29	41193.433	V=12.00
1971 10 20	41245.283	V=12.00
1974 09 13	42304.348	B=15.60
1981 06 29	44785.463	B=14.90
1993 05 25	49133.438	V=13.70
1993 07 07	49175.525	B=14.50
1993 07 07	49175.538	V=14.30
1993 08 12	49212.379	B=15.30
1993 08 12	49212.408	V=14.00
1993 08 19	49219.453	V=14.40
1993 11 16	49308.345	B=12.70

date	*HJD*	*mag*
V443 Her		
1968 06 03	40010.514	B=12.85
1968 06 17	40025.434	B=12.70
1968 06 18	40026.449	B=12.70
1968 06 20	40028.422	B=12.55
1968 06 21	40029.449	B=12.80
1968 06 22	40029.517	B=12.60
1968 06 24	40032.446	B=12.70
1968 06 30	40038.410	B=12.60
1968 09 17	40117.323	B=12.60
1972 08 08	41538.449	B=12.30
1972 08 12	41542.435	B=12.30
1972 08 12	41542.456	B=12.40
1972 08 12	41542.474	B=12.35
1972 08 13	41543.403	B=12.35
1972 08 13	41543.419	B=12.30
1972 08 13	41543.440	B=12.30
1972 08 15	41545.440	B=12.25
1972 08 15	41545.454	B=12.25
1972 08 15	41545.468	B=12.40
1972 08 16	41546.436	B=12.40
1972 08 16	41546.466	B=12.40
1972 08 16	41546.481	B=12.35
1972 09 28	41589.308	B=12.40
1972 09 29	41590.369	B=12.40
1972 11 03	41625.317	B=12.35
1972 11 06	41628.250	B=12.40
1972 11 08	41630.289	B=12.35
1973 05 26	41828.559	B=12.60
1973 06 29	41863.424	B=12.60
1973 06 29	41863.443	V=11.45
1973 07 03	41867.433	B=12.60
1973 07 03	41867.469	B=12.60
1973 07 04	41867.506	B=12.60
1973 07 21	41885.403	B=12.50
1973 07 22	41886.420	B=12.75
1973 07 22	41886.434	B=12.50
1973 07 25	41889.457	B=12.50
1973 07 26	41889.518	B=12.60
1973 07 26	41890.476	B=12.65
1973 07 27	41890.507	B=12.60
1973 07 27	41890.535	B=12.60
1973 07 28	41892.436	B=12.80
1973 07 28	41892.461	B=12.50
1973 08 05	41900.424	B=12.65
1973 10 19	41975.248	B=12.45
1973 10 20	41976.254	B=12.40
1974 05 27	42194.579	B=12.50
1974 06 13	42212.452	B=12.50
1974 06 15	42214.458	B=12.50
1974 07 15	42244.486	B=12.55
1974 07 16	42244.500	B=12.45
1974 07 16	42244.514	B=12.50
1974 07 19	42248.437	B=12.50
1974 07 21	42250.467	B=12.45
1974 07 21	42250.484	B=12.55
1974 07 23	42251.540	B=12.50
1974 08 13	42273.459	B=12.60
1974 08 13	42273.474	B=12.50
1974 08 15	42275.409	B=12.60
1974 08 15	42275.423	B=12.60
1974 08 17	42277.447	B=12.60
1974 08 17	42277.461	B=12.70
1974 08 20	42280.410	B=12.50
1974 08 20	42280.424	B=12.60
1974 09 10	42301.365	B=12.55
1974 09 12	42303.447	B=12.70

Table 2. (*continues*)

date	*HJD*	*mag*
V443 Her		
1974 09 13	42304.365	B=12.65
1974 09 14	42305.330	B=12.80
1974 09 14	42305.345	B=12.90
1974 09 14	42305.359	B=12.80
1974 09 16	42307.412	B=12.80
1974 10 09	42330.416	B=12.55
1974 10 17	42338.303	B=12.60
1975 06 04	42568.427	B=12.60
1975 06 13	42577.461	B=12.55
1975 07 02	42596.480	B=12.80
1975 08 09	42634.440	B=12.50
1975 08 13	42638.430	B=12.30
1975 09 03	42659.430	B=12.40
1975 09 12	42668.497	B=12.30
1975 10 02	42688.392	B=12.45
1975 10 05	42691.353	B=12.50
1975 10 06	42692.357	B=12.40
1975 10 26	42712.268	B=12.15
1975 10 27	42713.268	B=12.25
1975 10 28	42714.270	B=12.30
1975 10 29	42715.367	B=12.25
1975 10 31	42717.368	B=12.25
1976 04 09	42877.618	B=12.30
1976 06 02	42932.409	B=12.50
1976 06 19	42949.463	B=12.50
1976 06 28	42958.479	B=12.50
1976 06 29	42959.451	B=12.50
1976 07 23	42983.424	B=12.80
1976 08 01	42992.420	B=12.60
1976 08 23	43014.380	B=12.60
1976 09 18	43040.351	B=12.50
1977 05 25	43288.586	B=12.40
1977 08 19	43375.433	B=12.50
1979 05 24	44017.590	V=11.45
1982 09 18	45231.318	B=12.30
1983 06 03	45489.501	B=12.40
1993 08 16	49216.468	I= 8.80
V627 Cas		
1969 11 03	40529.262	B=14.70
1969 11 03	40529.286	I= 8.80
1970 09 06	40836.433	B=14.75
1970 09 06	40836.460	I= 8.80
1970 10 22	40882.441	B=14.70
1970 10 22	40882.465	I= 8.80
1970 10 25	40885.418	B=14.70
1970 10 28	40888.485	I= 9.35
1970 10 29	40888.512	B=14.75
1970 11 04	40895.430	R=11.30
1970 11 04	40895.457	B=14.50
1970 11 27	40918.234	I= 8.85
1970 11 27	40918.259	B=14.55
1970 12 03	40924.317	I= 8.80
1970 12 03	40924.342	B=14.75
1970 12 20	40941.258	B=14.75
1970 12 20	40941.286	I= 8.85
1971 01 18	40970.230	I= 8.85
1971 08 15	41179.475	B=14.60
1971 08 16	41179.503	R=11.30
1971 08 16	41179.532	I= 9.80
1971 09 20	41215.478	B=14.50
1971 09 21	41215.509	I= 8.90
1971 10 20	41245.403	B=14.60
1971 10 20	41245.423	I= 8.80
1971 11 16	41272.393	B=14.60
1971 11 16	41272.425	I= 8.80
1971 12 05	41291.206	I= 8.80
1971 12 05	41291.230	B=14.65
1971 12 06	41292.213	I= 8.85
1971 12 06	41292.238	B=14.65

date	*HJD*	*mag*
V627 Cas		
1971 12 11	41297.247	I= 8.85
1971 12 11	41297.276	B=14.50
1971 12 14	41300.208	I= 8.80
1971 12 14	41300.236	B=14.50
1972 09 09	41570.448	B=15.00
1972 09 09	41570.474	I= 9.35
1972 10 15	41606.400	I= 9.35
1972 10 15	41606.420	B=14.90
1972 10 31	41622.398	B=14.90
1972 10 31	41622.421	I= 8.80
1972 11 04	41626.341	B=14.80
1972 11 04	41626.367	I= 9.10
1972 11 27	41649.225	I= 9.60
1972 11 27	41649.246	B=14.80
1972 12 07	41659.283	V=11.85
1972 12 07	41659.302	I= 9.10
1972 12 13	41665.457	I= 9.35
1972 12 13	41665.477	V=12.05
1972 12 23	41675.213	I= 9.35
1972 12 23	41675.233	V=12.50
1973 10 03	41958.548	I= 9.80
1973 10 03	41958.571	B=14.80
1973 10 20	41976.424	V=12.55
1973 10 20	41976.464	B=15.00
1973 10 24	41980.473	I= 9.80
1973 10 24	41980.496	B=14.95
1973 10 27	41983.382	B=14.75
1973 10 27	41983.401	V=12.50
1973 10 31	41987.464	B=14.70
1973 10 31	41987.485	I= 9.60
1973 11 15	42002.315	V=12.60
1973 11 30	42017.394	V=12.60
1973 11 30	42017.422	I= 9.60
1973 12 12	42029.242	V=12.60
1973 12 12	42029.267	I= 9.60
1973 12 17	42034.306	I= 9.60
1973 12 17	42034.327	V=12.60
1975 10 03	42689.367	B=14.80
1975 10 03	42689.389	I= 9.60
1975 10 26	42712.388	B=14.65
1975 10 26	42712.416	I= 9.60
1975 11 29	42746.314	B=14.85
1975 11 29	42746.336	I= 9.80
1976 09 17	43039.468	B=14.90
1976 09 17	43039.489	I= 8.85
1976 10 22	43074.316	I= 8.80
1976 10 22	43074.341	B=14.80
1976 12 14	43127.397	B=14.90
1976 12 14	43127.421	I= 8.85
1977 09 05	43392.472	I= 9.35
1977 09 05	43392.494	B=15.50
1977 09 11	43398.460	I= 9.10
1977 09 11	43398.485	B=15.50
1977 09 18	43405.431	B=15.55
1977 09 18	43405.462	I= 9.60
1977 10 03	43420.403	I= 9.35
1977 11 04	43452.278	I= 9.35
1977 11 16	43464.351	I= 9.10
1977 12 02	43480.354	B=15.40
1977 12 02	43480.439	I= 9.35
1977 12 14	43492.303	I= 9.35
1977 12 14	43492.381	B=15.60
1978 10 07	43789.409	V=12.60
1978 10 07	43789.433	I= 9.60
1979 08 30	44116.380	I= 9.60
1979 08 30	44116.495	B=15.60
1979 09 26	44143.443	I= 9.60
1979 09 26	44143.471	B=15.60
1979 10 25	44172.450	B=15.75
1979 10 25	44172.471	I= 9.60
1980 11 08	44552.478	V=12.60

date	*HJD*	*mag*
V627 Cas		
1980 11 09	44552.502	I= 9.60
1980 11 13	44557.427	B=15.85
1980 11 13	44557.454	I= 9.60
1981 09 06	44854.403	I= 9.60
1981 10 27	44905.459	B=15.60
1981 11 02	44911.348	I= 9.60
1981 11 02	44911.377	B=15.60
1981 11 24	44933.410	B=15.55
1981 11 24	44933.441	I= 9.35
1982 10 21	45264.323	I= 9.60
1982 10 21	45264.353	V=12.60
1982 11 16	45290.377	B=15.65
1983 09 13	45591.417	I= 9.60
1983 09 13	45591.442	V=12.80
1983 10 03	45611.462	B=15.60
1993 08 23	49223.387	R=11.90
V919 Sgr		
1961 06 19	37469.561	B=13.80
1967 06 30	39672.486	B=13.90
1967 07 01	39672.517	I=10.20
1967 07 27	39699.432	I=10.20
1967 07 28	39700.413	B=13.95
1967 07 28	39700.429	I=10.15
1967 07 29	39701.431	I=10.20
1967 07 29	39701.458	B=13.95
1967 07 31	39703.397	I=10.10
1967 07 31	39703.424	B=14.20
1967 08 03	39706.453	I=10.00
1967 09 06	39740.419	B=13.90
1967 09 27	39761.323	B=13.90
1967 09 29	39763.313	I=10.15
1967 10 05	39769.268	I=10.20
1967 10 05	39769.298	B=14.10
1968 07 06	40043.514	B=14.20
1968 07 06	40043.533	I=10.10
1968 07 20	40058.450	I=10.10
1968 07 20	40058.470	B=14.20
1968 07 22	40060.378	I=10.00
1968 07 22	40060.395	B=14.30
1968 09 18	40118.390	I=10.15
1968 09 24	40124.356	B=14.40
1968 09 24	40124.376	I=10.25
1968 10 19	40149.257	I=10.25
1968 10 19	40149.269	B=14.50
1968 10 24	40154.256	I=10.10
1968 10 24	40154.267	B=14.40
1969 05 23	40364.594	I= 9.90
1969 05 27	40368.563	I=10.10
1969 05 27	40368.577	B=14.45
1969 07 03	40405.521	B=14.15
1969 07 10	40413.491	B=14.10
1969 07 14	40416.537	I=10.20
1969 07 15	40418.398	B=14.40
1969 07 15	40418.416	I=10.10
1969 08 14	40448.436	I=10.10
1969 08 16	40450.421	B=14.00
1969 09 15	40480.400	B=14.00
1969 09 15	40480.418	I=10.10
1969 10 09	40504.305	I=10.15
1969 10 09	40504.321	B=14.35
1969 10 10	40505.337	I=10.20
1969 10 13	40508.290	I=10.20
1969 10 13	40508.306	B=14.00
1969 10 16	40511.257	I=10.20
1970 08 02	40801.453	I=10.20
1970 08 02	40801.467	B=14.30
1970 08 06	40805.447	B=14.20
1970 08 06	40805.457	I=10.15

against the $UBV(RI)_{\rm C}$ comparison sequences calibrated by Henden and Munari (2000). These comparison sequences proved to work perfectly, covering the range of variability of the program stars and with both the comparison stars and the variable visible at the same time in the eyepiece field of the microscope. The exception has been V627 Cas, which was brighter than the comparison sequence in some of the R and I plates. We then searched outside the field explored by Henden and Munari (2000) for bright stars that have been found constant in brightness by Hipparcos/Tycho. We converted their Tycho B_T, V_T magnitudes into Johnson's standard B and V values, and using the transformations of Caldwell et al. (1993) we eventually derived their $R_{\rm C}$ and $I_{\rm C}$ magnitudes. These transformation relations between colors in the $UBV(RI)_{\rm C}$ system gives accurate results *provided* that the stars belong to the solar neighborhood population, the reddening is not large and the luminosity class is roughly known. We have assumed all the selected Tycho objects to be nearby main sequence stars. Thus, the $R_{\rm C}$ and $I_{\rm C}$ so derived may be considered only as guidelines useful for estimating photographic plates. The two stars we used to extend the $R_{\rm C}$ and $I_{\rm C}$ comparison sequences around V627 Cas are TYC 3997 2203 1 ($R_{\rm C}$ = 9.11 and $I_{\rm C}$ = 9.10) and TYC 3997 1868 1 ($R_{\rm C}$ = 8.71 and $I_{\rm C}$ = 8.67).

The data are presented in Table 1. The date (year/ month/ day/ format), the heliocentric JD and the estimated magnitude (in steps of 0.05 mag) are given. Further details (including plate number, exposure time, emulsion and filter types, etc.) are available via http://ulisse.pd.astro.it/symbio_pg/.

3. Notes on individual objects

Brief notes follow to comment upon the photometric behavior displayed by the program stars.

Ap 3-1 varied by $\triangle I \sim \triangle B \sim 1$ mag over the 26 years covered by the Asiago plates in Table 1, but without following any obvious periodic pattern or monotonic trend.

V1413 Aql. The 1962-1981 sub-set of plates were already analyzed by Munari (1992) against a different comparison sequence. The Table 1 data confirm the pre-outburst lightcurve modulated by a reflection effect following the 434.1 day orbital period of the post-outburst eclipses.

V443 Her. 96 of the 100 B band data in Table 1 cover the period 1968-1977. They confirm in periodicity (594 day) and amplitude ($\triangle B \sim 0.4$ mag) the later 1979-1993 B lightcurve of Kolotilov et al. (1995). Unavoidable small differences in pass-band profiles between the photoelectric and photographic realization of the B band can contribute to the slight difference in mean brightness (B =12.43 for Kolotilov et al. photoelectric photometry, B =12.53 for Table 1 data).

V919 Sgr. Our 1961-1970 data are affected only by a small amplitude variability: $\triangle I$ ∼0.3 and $\triangle B$ ∼0.5 mag.

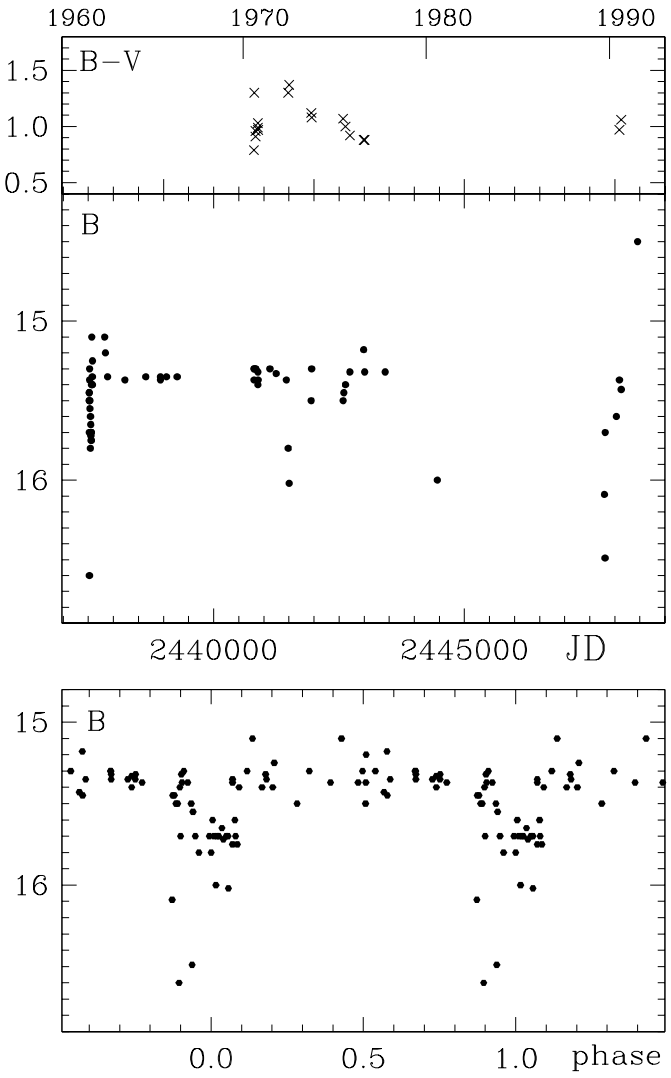

Fig. 1. B and B–V lightcurves of AS 323 (*upper panels*). The B data folded onto a P=197.6 day period (*lower panel*).

3.1. AS 323

Originally classified as a planetary nebula (= K 4–7 = PK 26 −2°2), the symbiotic nature of AS 323 has been discovered by Sabbadin (1986) and Acker et al. (1988). The spectrum resembles a proto-type symbiotic star, with well developed TiO bands in the red, veiling by the circumstellar nebula in the blue and a high ionization emission line spectrum (He II 4686 Å and 6825 Å Raman scattering of O VI are both prominent), with weak or absent nebular lines. Mikolajewska et al. (1997) estimated a M3 spectral type for the cool giant and T_{eff} ≥100 000 K and L =1200 $L_\odot$ for the hot companion. Munari et al. (2001) report $B = 15.18$, $B-V = +0.99$, $U-B = -0.42$, $V-R_C = +1.11$ and $R_C-I_C = +1.39$ for observations obtained in 1999.

The AS 323 data from Table 1 are plotted in Figure 1. The 1960-1990 lightcurve is characterized by a flat quies-

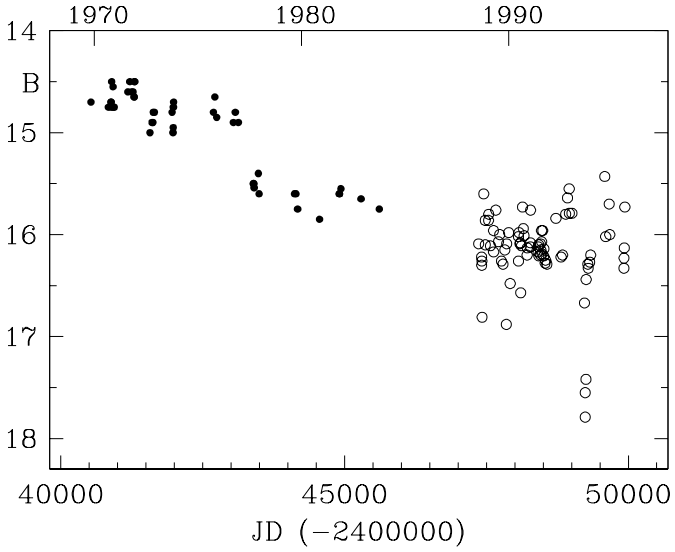

Fig. 2. B lightcurve of V627 Cas (=AS 501). *Dots*: data from Table 1. *Open circles*: photoelectric photometry by Kolotilov et al. (1996).

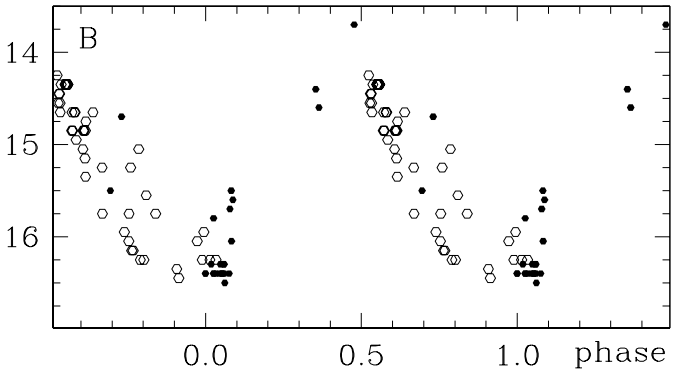

Fig. 3. The B data of CM Aql folded onto a P=1058 day period. *Dots*: data from Table 1. *Open circles*: data from Harwood (1925).

cence level at B ∼15.3, close to the 1999 value. A sudden brightening occurred at the very end of the observational period: its detection is solid given the careful check of the AS 323 image on the plate that excluded local defects.

The most interesting aspect of the AS 323 lightcurve is however the series of drops below the quiescent level. A search for periodicities has revealed several possible periods, the stronger one being P=197.6 days. The B data are phase-plotted against it in Figure 1, showing a lightcurve closely resembling a deep eclipsing binary ($\triangle B \sim 1.5$ mag). More data are however necessary to firmly establish the periodicity, refine the period and confirm the suspected eclipsing nature. Hopefully, similar programs could locate in other archives more plates containing AS 323 and solve the issue.

If the P=197.6 days should be confirmed as the orbital period of AS 323, it would be the shortest known among symbiotic stars, with the closest cases being TX CVn (199 days), T CrB (228 days) and BD-21.3873 (282 days; cf. Belczyński et al. 2000). The M3 giant in AS 323 would then quite probably fill its Roche lobe and show the characteristic *ellipsoidal* distortion of its lightcurve.

3.2. V627 Cas

According to Kolotilov et al. (1996), V627 Cas (=AS 501) is an unusual type of symbiotic star because it could harbor a post-AGB cool giant. During the post-AGB phase a star is supposed to evolve very rapidly. The secular decrease in brightness evident in Figure 2 could be then ascribed to global modifications of the cool giant that dominates the emission of V627 Cas in the B band.

Kolotilov et al. (1996) also reported on a small amplitude pulsation of the cool giant with a period of P=466 days. This periodicity (or any other else) does not seem to be present in the B or I band data of Table 1, which cover an earlier time interval. The fact that the cool giant may have started to pulsate on such short time scales may again argue in favor of the Kolotilov et al. (1996) scenario of a post-AGB, rapidly evolving star.

3.3. CM Aql

According to the extensive literature search by Kenyon (1983), CM Aql has varied in the past between $16.4 \geq B \geq 13.2$, with outbursts recorded in 1914, 1925 (when it was discovered), 1934 and 1950.

Our data in Table 1 extend over $16.5 \geq B \geq 13.7$, the same as in older records, without evidence for separated quiescence and outburst phases and favoring instead a continuous variability. It has also to be noticed that at the time of the 1925 "outburst" HeII 4686 was in strong emission (Harwood 1925), contrary to the typical behavior of symbiotic stars.

We argue that the variability so far observed in CM Aql is not modulated by outbursts, but it is instead periodic in nature. In Figure 3 the data of Harwood (1925) and those of Table 1 are phase plotted according to a period of P=1058 days. The sinusoidal shape would suggest a *reflection effect* interpretation. A $\triangle B$ ∼2 mag amplitude would however be unusually large for a symbiotic star. Clearly, further data from other plate archives are necessary to firmly address the period, the nature of the sinusoidal-like variability and the absence of outbursts.

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